# AN ECOLOGICAL COMPARISON BETWEEN THE AVIFAUNAS OF OHIO AND DENMARK

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## INTRODUCTION

It is always of great interest for the ornithologist to visit new areas and see new birds. When in a new region the ornithologist invariably compares the new area with his home region, looks for birds he knows and birds he does not know; and all of what he sees is grouped and arranged according to how the bird life is back home.

When the ornithologist finds himself in quite another part of the world he first really starts in to wonder and compare. Familiar species are greeted as old friends; species closely related to familiar ones enter as components of the avifaunistic picture, substituting well-known ones. New and unknown species are studied with the eagerness of a curious boy in the woods.

Gradually the bird communities of the new area are dissolved in their components; species, that at the beginning seemed so unfamiliar, are now found to occupy the same ecological niches as some known species back home.

Finally, after having been in the new area a sufficient length of time, the ornithologist feels more or less "at home," because the composition of various bird communities now seems familiar.

I have had the opportunity now for two years to study at the Ohio State University, Columbus, Ohio, as a Research Fellow of the Ohio Wildlife Research Unit. Coming from my cooler northern homeland, Denmark, the stay in this much more southern area has been of utmost interest and fascination to me. My first meetings with hummingbirds and vultures will always be red letter days for me.

The objective of this study is to show similarities and differences in the avifaunas of these two widely separated regions and attempts to explain some of the reasons underlying those conditions.

The justification for presenting this paper is the fact that Ohio and Denmark, in spite of their belonging to two different continents and placed at quite different latitudes, yet show a degree of similarity in avifaunistic composition. This is most pronounced with the shoreline community, of which Denmark can show a high diversity and richness, whereas the Lake Erie shoreline of Ohio is but a small part and in many places little or not at all suitable for shorebirds and waterfowl.

## CHARACTERISTIC FEATURES OF OHIO AND DENMARK

The location of Ohio and Denmark on two different continents and at quite different latitudes does not suggest many possibilities of similarity in general features. Yet, several conditions are more or less alike, e.g., the land-use patterns. On the other hand, many differences occur, as the very hot Ohio summers, the

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intensive and violent rains of Ohio, the light summer nights of Denmark, and many other characteristic features of the two countries.

It has therefore seemed advisable, before making an avifaunistic comparison, to discuss briefly the most conspicuous similarities and differences in the general features of the two areas.

### (*a*) *Climate*

The rather great differences in the climates of Ohio and Denmark are due not only to the different geographical positions, Ohio being situated at around 40° n. lat., Denmark at 56° n. lat., but also by the fact that Ohio has a continental climate as part of a vast continent, whereas Denmark has an insular or maritime climate, tempered by the surrounding sea.

The greatest differences, which also will appear from the graph, Fig. 1, may be summarized as follows (data from Alexander and Patton, 1929, and H. Larsen & Bo Bramsen, 1943):

Ohio has rather cold winters with unsteady cold weather; the winter is characterized by relatively little snow, occasional extremely low temperatures occurring during cold spells and many thaws and fairly mild weather between the cold spells.

Denmark has fairly mild winters considering its northern location, with prolonged cold periods when winter really starts in, which does not happen every year; however, the winters of 1940–42, and 1947 were extremely long and cold. The cold is more steady, with periods of continuous frost lasting as long as 40 days.

Ohio has very hot, sunny and long summers, whereas the summers of Denmark are short and cool with much less sunshine. Some summers only a week or a few weeks are vacation weather with sunshine and warmth in Denmark. Denmark has an esthetic and practical advantage over Ohio in its light summer nights, characteristic of the northern latitudes, namely, in the months of May, June and July.

The annual mean temperature for Ohio is 10.5° C., in Denmark 7.4° C. The highest temperature measured in Ohio is 45° C., in Denmark 35.8° C. The lowest temperature measured in Ohio is −39° C., in Denmark −31° C.

The rainfall in Ohio is great, averaging 988 mm. a year; maximum precipitation a year, 1,278 mm.; the driest year had 711 mm. rainfall. The rainfall in Denmark is relatively slight, averaging 612 mm. a year; maximum precipitation a year, 805 mm.; driest year, 491 mm.

The relative humidity is less in Ohio than in Denmark, averaging 71 and 83 per cent respectively.

Ohio averages many more hours of sunshine than Denmark and as examples the figures for the summer months may be given. In June Ohio has 306, Denmark 261 hours of sunshine; in July Ohio has 327, Denmark 250 hours of sunshine, and in August Ohio has 286, Denmark 227 hours of sunshine.

Finally, it may be mentioned that it is very windy in Denmark. Annually only 4% of the days are calm; the force of the wind averages 6–8 m. per second (in winter 7.5, in summer 6.1). Highest wind velocity measured in Denmark was 35 m. per second.

### (*b*) *Topography and land-forms*

Parts of Ohio and Denmark are similar in topography, namely, the flat regions of unglaciated Ohio and the flat, tundra-like heath of unglaciated western Denmark and to some extent also rather flat areas on some of the islands. Eastern Ohio is hilly and undulating and is similar to parts of eastern Jutland.

The characteristic features of Denmark are its long shoreline, the long fjords cutting into the country, the many (483) islands scattered around in the sea, the bays and marshes, the heath, and the sand-dunes along the sea-shore. Ohio has nothing comparable to these features, except for the Lake Erie shoreline and

the Bass Island group in the lake. Rocky islands, belonging to Denmark, are found in the Baltic Sea.

Taken as a whole, however, the two areas are dissimilar. Greatest similarity is found between the Lake Erie shoreline of Ohio and the Danish sea-shoreline; and as it will be shown later on, it is in these areas that the greatest similarities are to be found in the avifauna of the two countries.

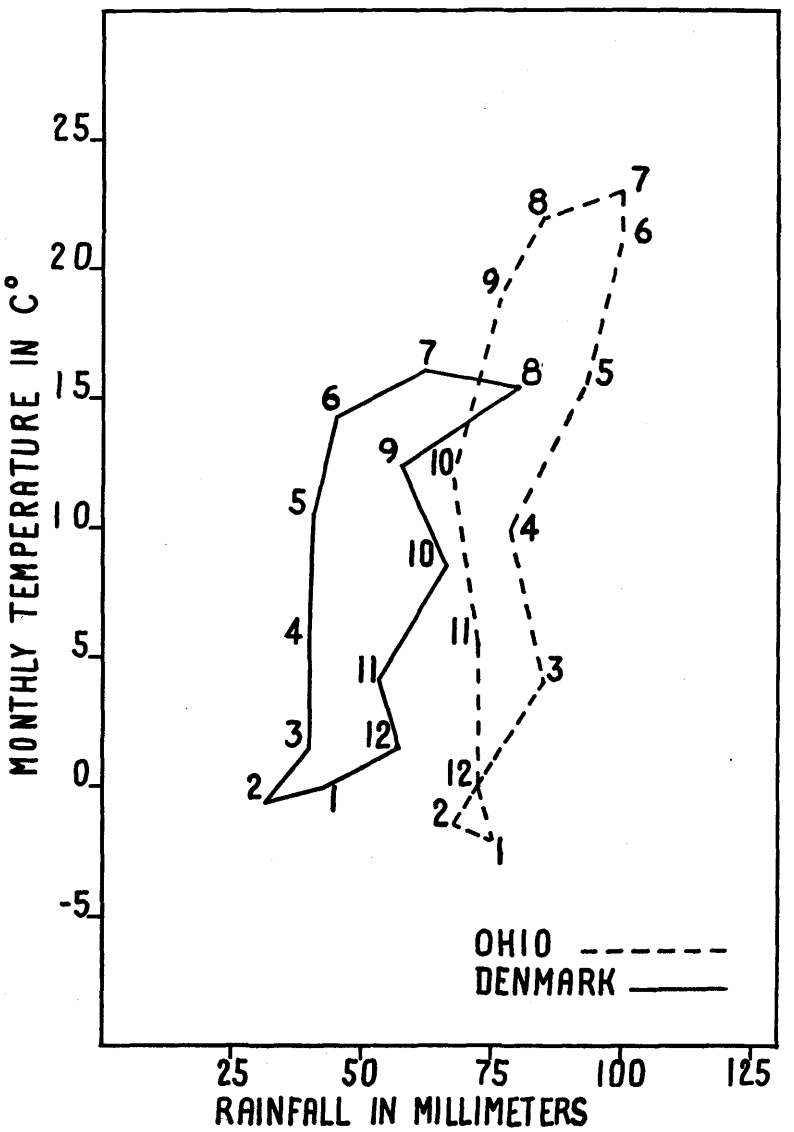


FIG. 1. Climograph of Ohio and Denmark. Months are indicated by the numbers 1–12.

### (*c*) *Vegetation*

Ohio has a rich and varied flora composed of approximately 2200 flowering plants (including 500 introduced species), 69 ferns, and 700 mosses and lichens. Several forest climaxes are found, as Mixed-mesophytic and Hemlock-Beech; the most common trees are the oaks, comprising 39.3% of the total forest area, followed closely by beech, maples, elm, ashes, hickories, etc. In all 120 varieties of native trees are found in Ohio. In the southeastern and eastern parts of the state conifers occur on drier sites; most common are Virginia pine, *Pinus virginiana*, and Pitch pine, *Pinus rigida*. Fourteen per cent of the total area is forested, and of this area 99% is deciduous forest, and 1% conifers.

Except for the forest land the main part of Ohio is farmland without characteristic or outstanding plant communities.

The vegetation of Denmark is central European with northern and boreal characteristics in certain areas, e.g., the heath. The flora is composed of about 1400 species of flowering plants, 30 ferns and 450 species of mosses and lichens. The climax forest type is deciduous forest with beech, *Fagus silvatica*, as the main tree, but, in addition, oaks, ashes, linden, birch, elm, etc., are found. In Jutland the dominating forest type is conifers, mainly Norway spruce, *Picea abies*, pines and firs; 8.5% of the land area is forested, and of this area 43% is deciduous forest, and 57% conifers. Characteristic for the Danish forest is its few tree species, the 5 main species occupying as much as 84% of the total forest area.

Another characteristic of the Danish flora is the tundra-like heath in the former unglaciated part of western Jutland; the heath, bogs and sand-dunes occupy about 10% of the total land area. The characteristic plant of the heath is heather, *Calluna vulgaris*, and other common species are cranberry, *Vaccinium vitis-idaea*, black crow-berry, *Empetrum nigrum*, lichens and mosses.

Along the west coast of Jutland and also in other places several rows of sand-dunes are found, building a barrier against the violent storms from the sea. Characteristic plants of the sand-dunes are lyme-grass, *Elymus arenarius*, and sea sand-reed, *Ammophila arenaria*.

### (*d*) *Land-use*

The land-use in Ohio and Denmark is similar in that farm land occupies about three-fourths of the total area, and the rest is occupied by forests, towns, roads, etc. Denmark has a 10% area, namely heath, bogs and sand-dunes, of which no comparable unit is found in Ohio.

Both states are thus mainly agricultural, but differences in crops, farming methods and soil types result in a rather different general appearance of farm lands. Ohio farms are rather large, averaging 99 acres per farm, whereas the average Danish farm covers 42 acres. Several big estates, comprising many hundred and up to several thousand acres are found in Denmark. Most of the farm land in Denmark is more rolling than in Ohio. Ohio fields are much bigger than average Danish fields; Ohio fields are mostly rectangular and regular in shape, whereas most Danish fields (mainly because of age and the very early dividing up of land) are rather irregular in shape. Many fields in Denmark are divided by living fencerows, and, in Jutland, windbreaks are very common. As a matter of fact they are a necessity for man's existence in that region. In Ohio, corn, wheat, oats and soybeans are the main crops, whereas in Denmark, barley, oats, beets and rye are the main crops.

The population density is a little different in the two areas. In Ohio there are 168 inhabitants per square mile (1940), in Denmark there are 244 inhabitants per square mile (1945).

TABLE I

LAND-USE PATTERNS IN OHIO AND DENMARK

| | Ohio (1930) | Denmark (1931) |
|---|---|---|
| Farm land | 82.0% | 75.0% |
| Forests | 14.0% | 8.5% |
| Heath, dunes | ..... | 10.0% |
| Towns, gardens, etc. | 2.0% | 2.5% |
| Roads, hedges | 2.0% | 2.0% |
| Lakes and streams | ..... | 2.0% |

## A COMPARISON OF OHIO AND DENMARK AVIFAUNAS TO SPECIES

The results of a comparison between Ohio and Danish avifaunas depend entirely upon how such a comparison is made.

If the list of identical species, given in Table 2, is used as a basis, without further consideration, it will be seen that ca. 100 species are alike, and it might accordingly be concluded that the avifaunas are much alike, almost 30% of the species being identical.

If a visit were made to a Lake Erie marsh or another waterfowl area, the number of various ducks, terns, gulls, bitterns, gallinules, coots, etc., would make the Dane feel very much at home.

If on the other hand a visit were made to Neotoma Valley in Hocking county, the differences would be so striking, that the Dane could hardly find one familiar species.

Similarly an Ohioan would feel homesick and helpless if put out on the tundra-like heaths and moorlands of western Jutland in Denmark; even the bird life of the woods would be new and unknown to him.

A closer consideration of the whole matter would therefore seem desirable.

For this reason a list (Table 2) is first given to be used as a basis for a qualitative comparison.

As indicated in Table 2, a total of 99 species of birds have been recorded from both Ohio and Denmark. This means that 29% of the birds recorded in Ohio have been reported in Denmark, and that 30% of the birds recorded in Denmark have also been reported in Ohio.

The total number of species recorded in Ohio is 343 (Trautman, 1935: 331 species, plus 12 species by Borror, 1941) of which 152 or 44% of the total number are regular and fairly common to common breeding birds.

The total number of species recorded in Denmark is 334 (Löppenthin, 1946: 333 species plus pheasant, which species is included in the Ohio list, too), of which 159 or 48% of the total number are regular, and fairly common to common breeding birds.

Although one may get the impression that there is a fairly high similarity between the composition of the avifaunas of Ohio and Denmark, a close analysis will, however, show that this is not the case. A very high number of the species are casual, several with only one record, in either or both lands, and only a few are common transients or breeding birds in both areas.

Artificial introductions account for 6 species, namely, mute swan, European partridge, starling, and English sparrow, that have been introduced into the United States from Europe, and either released in, or spread from releases to, Ohio; Canada geese have been introduced to a bird park in Sweden from where they, during the winter, have migrated to Danish coasts; released Canada geese in Danish parks are now breeding in a few places. The pheasant was introduced in both Denmark and Ohio.

## TABLE II

### List of Bird Species Recorded

List of bird species recorded from Ohio and Denmark, showing subspecific similarities and differences, and stating respective occurrence. System and nomenclature followed as by Löppenthin (1946); Ohio records after Trautman (1935) and Borror (1941). Key to symbols used: C = Common; Ca. = Casual (accidental or far from its usual range); E = Exterminated in Ohio; L = Local; M = Migrant; N = Nests; R = Rare, but few recorded yearly; Res. = Resident, found at all seasons; Rec. = Record; S = Summer; U = Uncommon, occurring but in small numbers; V = Very; W = Winter; ? = Old established record being questioned, due to lack of any proof. Combinations as e.g., VRM, mean accordingly: very rare migrant. A dash (—) under the subspecific heading means that no subspecies are found, and the species are thus identical.

| Common Name | Scientific Name | Subspecies in | | Occurrence in | |
|---|---|---|---|---|---|
| | | Ohio | Denmark | Ohio | Denmark |
| Red-throated loon... | *Colymbus stellatus**... | — | — | VRM | CW, US |
| Black-throated loon. | *Colymbus arcticus*..... | — | — | ? | CW, US |
| Common loon..... | *Colymbus immer*..... | — | — | UM | UW, RS |
| Horned grebe..... | *Podiceps auritus*..... | — | — | CM | UM, UW |
| Eared grebe..... | *Podiceps nigricollis*... | *californicus*... | *nigricollis*.... | Ca. | NL, RM |
| Leach's petrel..... | *Oceanodroma leucorrhoa*..... | — | — | 1 Rec. | Ca. |
| Gannet..... | *Morus bassanus*..... | — | — | Ca. | LSW |
| Black-crowned night heron..... | *Nycticorax nycticorax*. | *hoactli*..... | *nycticorax*.... | UM, NL | Ca. |
| Eastern glossy ibis.. | *Plegadis falcinellus*.... | *falcinellus*.... | *falcinellus*.... | Ca. | Ca. |
| Mute swan..... | *Cygnus olor*..... | — | — | INTR. | NC |
| White-fronted goose.. | *Anser albifrons*..... | *albifrons*..... | *albifrons*..... | Ca. | UM, RW |
| Brant..... | *Branta bernicla*..... | *hrota*..... | *hrota*..... | Ca. | CM, CW |
| | | | *bernicla*..... | ..... | CM, CW |
| Barnacle goose..... | *Branta leucopsis*..... | — | — | ?Ca. | UM, UW |
| Canada goose..... | *Branta canadensis*..... | *canadensis*.... | *canadensis*.... | UM | INTR. |
| Mallard..... | *Anas platyrhynchos*... | *platyrhynchos* | *platyrhynchos* | CM, NR | NC, MC, WC |
| Blue-winged teal..... | *Anas discors*..... | — | — | CM, NL | Ca. |
| Green-winged teal.... | *Anas crecca*..... | *crecca*..... | *crecca*..... | Ca. | NL, CM |
| | | *carolinensis*... | — | CM | |
| Pintail..... | *Anas acuta*..... | *tzitzihoa*..... | *acuta*..... | CM, NR | NL, CM |
| European widgeon.... | *Anas penelope*..... | — | — | VRM | NR, CM |
| Gadwall..... | *Anas strepera*..... | — | — | UM | NR, UM |
| Shoveller..... | *Spatula clypeata*..... | — | — | UM, NR | NC, CM |
| Greater scaup..... | *Aythya marila*..... | *nearctica*..... | *marila*..... | VR | CW, RS |
| Golden-eye..... | *Bucephala clangula*.... | *americana*.... | *clangula*..... | UM, WRes. | CM, CW |
| Old-squaw..... | *Clangula hyemalis*..... | — | — | VUM | CW, US |
| Eider..... | *Somateria mollissima*. | *dresseri*..... | *mollissima*... | Ca.? | NCL, CM, CW |
| King eider..... | *Somateria spectabilis*. | — | — | VR | CaW |
| White-winged scoter. | *Melanitta fusca*..... | *deglandi*..... | *fusca*..... | UM | CM, CW |
| Goosander (Am. merganser)..... | *Mergus merganser*.... | *americanus*... | *merganser*.... | CM, CW | NL, CW |
| Red-breasted merganser..... | *Mergus serrator*..... | — | — | CM | NC, CM, CW |
| Osprey..... | *Pandion haliaetus*..... | *carolinensis*... | *haliaetus*..... | UM, NR | UM, NR? |
| Goshawk..... | *Accipiter gentilis*..... | *atricapillus*... | *gentilis*..... | RM, RW | NU, Res. |
| | | | *buteoides*..... | ..... | UM, UW |
| Rough-legged hawk. | *Buteo lagopus*..... | *s. johannis*.... | *lagopus*..... | UWRes. | CM, CW |
| Golden eagle..... | *Aquila chrysaetos*..... | *canadensis*.... | *chrysaetos*.... | RWRes. | UW |
| Marsh hawk..... | *Circus cyaneus*..... | *hudsonius*..... | *cyaneus*..... | CM, NL, CWRes. | CM, NRL, UW |
| Gyrfalcon..... | *Falco rusticolus*..... | *obsoletus*..... | *rusticolus*..... | 1Rec. | RW |
| Peregrine falcon..... | *Falco peregrinus*..... | *anatum*..... | *peregrinus*.... | RM, VRWRes. | NLR, CM, CW |
| Merlin..... | *Falco columbarius*..... | *columbarius*.. | *aesalon*..... | RM, VRWRes. | UM, RS |

* In American literature the loons are called Gavia.

Table II—(*Continued*)

| Common Name | Scientific Name | Subspecies in | | Occurrence in | |
|---|---|---|---|---|---|
| | | Ohio | Denmark | Ohio | Denmark |
| American kestrel | *Falco sparverius* | *sparverius* | *sparverius* | CRes. | Ca. |
| Partridge | *Perdix perdix* | *perdix* | *perdix* | INTR. | CRes. |
| Pheasant | *Phasianus colchicus* | mixed population | mixed population | INTR. | INTR. |
| Moorhen (gallinule) | *Gallinula chloropus* | *cachinnans* | *chloropus* | UM, NL | NC, UM |
| Black-bellied plover | *Squatarola squatarola* | — | — | UM | CM |
| Semipalmated plover | *Charadrius hiaticula* | *semipalmatus* | *hiaticula* | UM | NC, CM |
| Upland plover | *Bartramia longicauda* | — | — | UM, NL | Ca. |
| Hudsonian curlew (whimbrel) | *Numenius phaeopus* | *hudsonicus* | *phaeopus* | RM | CM, US |
| Lesser yellow-leg | *Tringa flavipes* | — | — | CM | Ca. |
| Ruddy turnstone | *Arenaria interpres* | *morinella* | *interpres* | VUM | NL, UM |
| Long-billed dowitcher | *Macrorhamphus griseus* | *scolopaceus* | *scolopaceus* | VRM | Ca. |
| Wilson's snipe | *Capella gallinago* | *delicata* | *gallinago* | CM | NC, CM, UW |
| Sanderling | *Crocethia alba* | — | — | UM | UM, RW |
| Knot | *Calidris canutus* | *rufus* | *canutus* | RM | CM, RS |
| Purple sandpiper | *Calidris maritima* | *maritima?* | *maritima* | VRM | UM, UW |
| Red-backed sandpiper | *Calidris alpina* | *pacifica* | *schinzii* | UM | NCL, CM |
| | | | *alpina* | ..... | CM, RW |
| Buff-breasted sandpiper | *Tryngites subruficollis* | — | — | VRM | Ca. |
| Ruff | *Philomachus pugnax* | — | — | 2 Rec. | NLC, CM |
| Red phalarope | *Phalaropus fulicarius* | — | — | Ca. | VRM, VRW |
| Northern phalarope | *Phalaropus lobatus* | — | — | VRM | UM, RW |
| Northern skua | *Stercorarius skua* | *skua* | *skua* | Ca. | Ca. |
| Pomarine jaeger | *Stercorarius pomarinus* | — | — | Ca. | UM |
| Parasitic jaeger | *Stercorarius parasiticus* | — | — | VR | UM, RS |
| Long-tailed jaeger | *Stercorarius longicaudus* | *longicaudus?* | *longicaudus* | 1 Rec. | UM |
| Herring gull | *Larus argentatus* | *smithsonianus* | *argentatus* | NL, CM, UWRes. | NC, CM, CW |
| Great black-backed gull | *Larus marinus* | — | — | Ca. | NL, CW |
| Glaucous gull | *Larus hyperboreus* | *hyperboreus* | *hyperboreus* | Ca. | UW |
| Iceland gull | *Larus glaucoides* | — | — | VR | Ca. |
| Kittiwake | *Rissa tridactyla* | *tridactyla* | *tridactyla* | Ca. | NL, USW |
| Sabine's gull | *Xema sabini* | — | — | Ca. | Ca. |
| Black tern | *Chlidonias niger* | *surinamensis* | *niger* | UM, NLC | NLC, RM |
| Gull-billed tern | *Gelochelidon nilotica* | *aranea* | *nilotica* | ? | NL, RS |
| Caspian tern | *Hydroprogne tshegrava* | — | — | UM | NCa.?, RM |
| Common tern | *Sterna hirundo* | *hirundo* | *hirundo* | CM, NL | NC, CM |
| Roseate tern | *Sterna dougallii* | *dougallii* | *dougallii* | Ca. | Ca. |
| Least tern | *Sterna albifrons* | *antillarum* | *albifrons* | VR | NLC, RM |
| Brunnich's murre | *Uria lomvia* | *lomvia* | *lomvia* | Ca. | UW |
| Yellow-billed cuckoo | *Coccyzus americanus* | *americanus* | *americanus* | CM, NL | Ca. |
| Barn owl | *Tyto alba* | *pratincola* | *guttata* | URes. | NC, Res. |
| Snowy owl | *Nyctea scandiaca* | — | — | UWRes. | UWRes. |
| Hawk owl | *Surnia ulula* | *caparoch* | *ulula* | R, VRN | RW |
| Long-eared owl | *Asio otus* | *wilsonianus* | *otus* | R, VRN | NC, UM, UW |
| Short-eared owl | *Asio flammeus* | *flammeus* | *flammeus* | UM, VRN | NLC, UM |
| Horned lark | *Eromophila alpestris* | *praticola* | *flava* | CM, CN | UM, UW |
| | | *alpestris* | ..... | CWRes. | |
| Barn swallow | *Hirundo rustica* | *erythrogaster* | *rustica* | VCM, CN | NC, CM |
| Bank swallow | *Riparia riparia* | *riparia* | *riparia* | CM, UN | NC, CM |
| Raven | *Corvus corax* | *principalis* | *corax* | Ext. | NL, Res. |

Table II—(*Continued*)

| Common Name | Scientific Name | Subspecies in | | Occurrence in | |
|---|---|---|---|---|---|
| | | Ohio | Denmark | Ohio | Denmark |
| Magpie | *Pica pica* | *hudsonia* | *pica* | Ca. | NC, Res. |
| Black-capped chickadee | *Parus atricapillus* | *atricapillus* | *salicarius* | URes. | VR? |
| Brown creeper | *Certhia familiaris* | *americana* | *macrodactyla* | CM, UWRes. | NC, Res. |
| | | | *familiaris* | | NLC, UW |
| Winter wren | *Troglodytes troglodytes* | *hiemalis* | *troglodytes* | CM, UWRes. | NC, CM, CW |
| Water pipit | *Anthus spinoletta* | *rubescens* | *littoralis* | CM | NL, CM |
| Waxwing | *Bombycilla garrulus* | *pallidiceps* | *garrulus* | VRWRes. | CW |
| Northern shrike | *Lanius excubitor* | *borealis* | *excubitor* | VRWRes. | NL, CM, CW |
| Starling | *Sturnus vulgaris* | *vulgaris* | *vulgaris* | INTR. | NC, CM |
| House sparrow | *Passer domesticus* | *domesticus* | *domesticus* | INTR. | NC, Res. |
| Redpoll | *Carduelis flammea* | *linaria* | *flammea* | VRWRes. | CM, CW |
| | | | *holboellii* | | UW |
| | | *exilipes* | *exilipes* | Ca. | Ca. |
| Pine grosbeak | *Pinicola enucleator* | *leucura* | *enucleator* | Ca. | RW |
| Red crossbill | *Loxia curvirostra* | *pusilla* | *curvirostra* | VRWRes. | NU, UM |
| White-winged crossbill | *Loxia leucoptera* | *leucoptera* | *bifasciata* | VRWRes. | UW |
| Lapland longspur | *Calcarius lapponicus* | *lapponicus* | *lapponicus* | RWRes. | UW |
| Snow bunting | *Plectrophenax nivalis* | *nivalis* | *nivalis* | RWRes. | CM, CW |

The remaining 93 species can roughly be divided up into six groups:

1. Species that are rare and casual in both areas, occurring as transients or visitors: Leach's petrel, Eastern glossy ibis, king eider, golden eagle, gyrfalcon, long-billed dowitcher, sanderling, buff-breasted sandpiper, red phalarope, northern skua, Iceland gull, Sabine's gull, roseate tern, snowy owl, pine grosbeak.

Of the 16 species rare in both countries almost all of them are occasional stragglers from the north, exceptions are Eastern glossy ibis and roseate tern. Eleven of them are water birds.

2. Species that occur in small numbers, scarce or irregular in both areas are: Common loon, and Caspian tern, of which the latter is an irregular breeding bird in Denmark, breeding with an interval of many years. Both are northern species.

3. Species that are rare in the one and scarce or irregular in the other area.

Species rare in Ohio, and scarce or irregular but more numerous in Denmark are: Gannet, white-fronted goose, barnacle goose, merlin, purple sandpiper, northern phalarope, pomarine jaeger, parasitic jaeger, long-tailed jaeger, glaucous gull, Brunnich's murre, white-winged crossbill and Lapland longspur.

These 13 species are all more northern breeding species; the European gannets do, however, breed as far south as Wales in England. Ten of the species are water birds.

4. Species rare in the one and common transients in the other area.

Species rare in Ohio, common in Denmark:

Rough-legged hawk
Black-bellied plover
Hudsonian curlew (whimbrel)
Knot
Bohemian waxwing
Redpoll
Snow bunting

Species rare in Denmark, common in Ohio:

Lesser yellow-leg

Of the eight species in this group, seven, namely, those rare in Ohio, but common in Denmark, are northern species; three of them are water birds. The bird rare in Denmark and common in Ohio, the lesser yellow-leg, is an occasional straggler across the Atlantic.

5. Species breeding in one country, but not in the other.

| Species breeding in Denmark, and not in Ohio: | Species breeding in Ohio, and not in Denmark: |
|---|---|
| Eared grebe | Black-crowned night heron |
| Green-winged teal | Blue-winged teal |
| European widgeon | Osprey |
| Gadwall | American kestrel |
| Eider | Upland plover |
| Goosander (Amer. merganser) | Yellow-billed cuckoo |
| Red-breasted merganser | Horned lark |
| Goshawk | Black-capped chickadee |
| Peregrine falcon | |
| Semipalmated plover | |
| Ruddy turnstone | |
| Wilson's Snipe[2] | |
| Red-backed sandpiper | |
| Ruff | |
| Great black-backed gull | |
| Kittiwake | |
| Gull-billed tern | |
| Least tern | |
| Raven | |
| Magpie | |
| Brown creeper | |
| Winter wren | |
| Water pipit | |
| Northern shrike | |
| Red crossbill | |

An analysis of the above data shows that all of the 25 species, which are breeding birds in Denmark, but only transients or occasional visitors in Ohio (raven has been exterminated in Ohio), are without exception, northern species; 16 of them are water or wading birds.

Of the eight species recorded in, but not breeding in Denmark, four are occasional stragglers from North America, namely, blue-winged teal, American kestrel, upland plover and yellow-billed cuckoo, and each of them only recorded once in Denmark. The black-crowned night-heron occurs as an occasional visitor from southern Europe; the Scandinavian horned larks breed much farther north, namely, on the tundras and mountain plateaus of the Scandinavian peninsula (the complete difference in habitat and ecological requirements of Scandinavian and North American horned larks is so striking that a study of the subject might be worth while). Concerning the remaining two species, the osprey formerly bred commonly in Denmark, but is now exterminated; maybe one or a few pairs are still found; the subspecies of the black-capped chickadee is moving up into Denmark from the South, and is suggested as a possible breeding bird in southernmost Denmark (Löppenthin, 1946).

6. Species breeding in both countries are: Mallard, pintail, shoveller, marsh hawk, gallinule, herring gull, black tern, common tern, barn owl, long-eared owl, short-eared owl, barn swallow, bank swallow.

With the exception of the marsh hawk, of which family two other species are more common breeding birds in Denmark, all of the species mentioned in this group are common breeding birds

[2]Listed by Trautman (1935: 7) as common migrant only. Hicks (1935: 152) lists it as a breeding bird in three northeastern counties, but says the "species is likely to disappear as a breeding bird within a few years."

in Denmark, whereas in Ohio only a few of them are so widely distributed in the state that they may be called common.

Mallard, pintail, shoveller, herring gull, black tern and common tern are restricted to a few areas along or in Lake Erie; marsh hawk, gallinule, long-eared owl, and bank swallow are mostly found in the northern part of the state; short-eared owl scattered, but mostly in the northern part; barn owl over most of the state, but most common in the southern part of the state; barn swallow is found all over the state of Ohio. Six of the 13 species are water birds.

## POSSIBLE REASONS FOR SIMILARITIES AND DIFFERENCES IN AVIFAUNAS

What conclusions may be derived from the above given data concerning composition, quantity, and reasons for differences in the avifaunas of these two remote areas? First, let us consider the number of species recorded. It is striking to see that Denmark, even if it is much smaller in area, has a list of species almost as long as that for Ohio (resp. 334 and 343). If the number of species recorded were in the same proportion to a unit of land as in Denmark, there should have been 831 species recorded from Ohio. Conversely, if the number of birds decreased in proportion to the unit of land there should only have been 138 species recorded from Denmark, which is less than the number of regular breeding birds in the country. Interpretation of the foregoing statements should not be misconstrued. It is not meant that the number of bird species within an area is proportional to the size of the area. Many other factors such as variety of habitats, geographical location, isolation, climate and vegetation are of much importance in this respect. Rather, it is the author's contention to point out the fact that more species could be expected from Ohio if its geographical location were similar to that of Denmark's. The land areas of Ohio and Denmark are respectively 41,222 and 16,576 square miles.

How does this diversity come about?

The reasons may be listed as follows:

(a) Denmark is the apex of the European continent and as such the connecting link (flyways and migration routes) between middle and western Europe and Fenno-Scandia–Siberia, as well as many northern birds winter in Denmark.

(b) Denmark is an archipelago consisting of one peninsula and 483 islands, thus getting its share of migrating and wandering around water birds.

(c) Denmark, because of its position between southern and northern faunas, gets its share of both faunas, further occasional visits of southern birds, and all northern migrants.

(d) Denmark has a diversity in vegetation, landscape form, and land-use not found in Ohio.

### (*a*) *Denmark as the apex of the European Continent*

The importance of peninsulas and islands as migration routes of birds has been known for a long time.

Denmark's geographical position as an apex of the European continent, with the Jutland peninsula protruding north from the continent and the islands extending eastward to the southern part of Sweden, makes the country a natural bridge for many of the birds coming from northern Scandinavia and Siberia.

Salomonson (1938: 36) mentions how the ducks wintering in England were shown by banding to come from Denmark, Sweden, Finland, western Russia, Balticum, most of these birds migrating in a southwesterly direction over Denmark. Blume and Frölich (1946) have recently shown how a great part of Scandinavian birds-of-prey migrate over the eastern part of Denmark.

Many of the birds coming from the North winter in Denmark. These include especially diving ducks in the seas around the country, but also loons, swans, certain birds-of-prey, and a few passerines, as the dipper, *Cinclus cinclus*, brambling, *Fringilla montifringilla* and snow-bunting, *Plectorphenax nivalis*.

The migration of many species, (one good example is the wood cock, *Scolopax*

*rusticola*), takes place from Jutland over Skagerrak to southern Norway or over Kattegat to Sweden. These birds thus migrate over a broad front, and during the migration seasons are found over nearly the whole country in suitable habitats. Others, as the above mentioned birds-of-prey, follow the eastern part of Sjælland and the smaller islands south of it. As indicated by Holm (1940), ducks (especially diving ducks), breeding in the Baltic Sea and the Gulf of Bothnia, migrate along the eastern shores of Sweden and enter Danish waters around the southern tip of Sweden.

As a matter of interest it should be pointed out that the Zoological Museum of Köbenhavns Universitet has an agreement with the personnel of the Danish light-houses that all birds killed by flying against the light-houses and found at the light-houses are to be turned in to the museum. A great number of birds are secured annually this way. It might also be mentioned that duck traps were legal up to 1931. In one of these, on the island of Fanö off the west coast of Jutland, 3100 ducks were caught annually from 1900–1927 (Weismann, 1939: 267), indicating the number of ducks passing by.

One difference between Ohio and Denmark is that Ohio as part of a vast continent, and without outstanding features of any kind to attract migrating birds, only gets a relatively small share of migrating birds, mostly land birds and birds migrating over a broad front, whereas Denmark lies on the direct migration routes and is passed by almost all of the birds migrating to or from Norway and Sweden, and also many birds from Finland, northern and western Russia and Balticum.

### (*b*) *Denmark as an Archipelago*

A comparison of the data in Table 2 and the other information given above shows that Denmark is ahead of Ohio concerning the frequency in which the different species in common occur, and further, that out of the 99 species, 63 (64 per cent) are water or wading birds, and of these 63 species 28 are more common in Denmark than in Ohio, and 15 of them breed in Denmark and not in Ohio.

The difference in composition in the avifaunas will also appear from a consideration of the total number of birds listed for the two areas.

Of Ohio's 343 species, 134 (39 per cent) are water or wading birds, of which 27 (20 per cent) do breed in Ohio.

Of Denmark's 334 species, 153 (46 per cent) are water or wading birds of which 65 (42 per cent) do breed in Denmark, most of them abundantly.

There can also be no doubt that several of the species which have occurred as occasional visitors in Denmark have come to the country because of its geographical position in the sea.

Good examples, for upholding this hypothesis, are some of the stragglers from North America: Blue-winged teal, lesser yellow-leg, and buff-breasted sandpiper, three species which undoubtedly never would have reached Denmark were it not for its location and connection with the Atlantic Ocean.

It is also characteristic that where, e.g., the lesser yellow-leg has occurred in Europe in addition to the Danish record it has been in countries with a seashore, namely, nine records from the British Isles, and it has also been recorded from Holland (Hörring, 1942: 45).

As another indicator of the importance of the surrounding sea the following might be mentioned. From the area around Herning in the heart of Jutland, 54 km. to the North Sea and one of the places in Denmark farthest away from the sea, Overgaard (1932) mentions 143 species of birds observed. Wittrup Jensen (1937) observed 105 species of birds in Fyn, on a farm 4 km. from the shore of the Great Belt. In contrast to this, Harboe (1939) observed 173 species at Præstö, at the seashore; and I have observed 194 species in my home region at Vejle, Vejle Fjord. It is characteristic, too, that the birds that are lacking in making up the greater species list in the inland areas are water and shore birds.

An illustration of the importance and abundance of the water bird group is also given in the annual kill records collected by the Danish Game Department.

The latest figures are from 1945 (Dansk Jagttidende, 64: 138), and show that the total kill of waterfowl, sea and shore birds for that year was:

371,674 pond ducks
130,551 diving ducks
9,814 geese
79,875 gulls
20,906 other swimming birds
27,950 wood cocks
41,282 snipes
28,508 curlews
2,605 herons
20,684 other shore birds

In all, 1,033,849 waterfowl, sea and shore birds were shot, most of which are good eatable game birds.

Comparable figures are unfortunately not available for Ohio, but the number of waterfowl shot is much less, and shore birds are not legal game birds in Ohio. Daniel L. Leedy's figures (1947: 5) show that 2.03 per cent of Ohio's total game kill is ducks, 0.05 per cent geese, and 0.3 per cent coots, waterfowl and other water birds in all comprising 2.38 per cent of the total game kill in Ohio, whereas this group of birds in Denmark comprises 54 per cent of the eatable game killed. In Ohio there was 0.26 duck shot per hunter, whereas in Denmark there were 5.5 duck shot per hunter, or 22 times more ducks shot per hunter in Denmark than in Ohio.

### (*c*) *Ohio and Denmark as border areas between North and South*

To some extent Ohio and Denmark occupy similar positions as border areas between north and south, both areas getting a fair share of the northern and southern bird elements. Very few of these northern birds, however, breed in Ohio, whereas many breed in Denmark; these species are listed in group 5, p. 23.

A comprison of the groups of birds listed, pp. 20–22, will show how most of the birds in common for Ohio and Denmark are most common in Denmark, and the ones that are not are mostly birds native of the North American Continent and so stragglers to Denmark.

Examples of some northern species that breed in Denmark, but only occur occasionally in Ohio, are eider, goosander (Am. merganser), goshawk, peregrine falcon, kittiwake, raven, magpie, northern shrike, and red crossbill.

Of the birds in common for the two areas, Ohio has the black-crowned night heron as a common breeding bird in suitable habitats; this bird is a southern species, and has only been recorded a few times from Denmark as a straggler from breeding colonies in southern Europe or Africa.

Other species, not found in Denmark, add much more to the southern character of Ohio's bird fauna, especially the New World birds: hummingbirds, and also the vultures. Vultures are found in southern Europe and Africa, from where three species (*Aegypius monachus*, *Gyps fulvus*, and *Neophron percnopterus*) have straggled to Denmark, a total of six individuals having been recorded from the country (Hörring, 1934).

Species, such as many New World warblers, *Parulidæ*, the various *Icteridæ*, tanagers, *Thraupidæ* and others, add still more to the southern characterized bird fauna of Ohio. Above all, the ruby-throated hummingbird, *Archilochus colubris*, is the sensation for the ornithologist from a nordic country.

The glossy ibis, which in North America breeds in peninsular Florida, and in

Europe in the Lower Danube valley, South Spain and South Russia, has been recorded in both Denmark and Ohio also.

### (*d*) *The diversity in landscape, vegetation and land-use in Denmark*

A very important factor for the large number of birds found in Denmark is the diversity of the Danish landscape.

Roughly speaking, Ohio consists of the flat western farm land part and the hilly eastern dairy section and southern forest land. In addition, the Lake Erie shoreline, rivers, lakes, and ponds add to its varying landscape.

In spite of its smallness Denmark shows a more varied type of landscape, including a long sea-shoreline (4,622 miles); a large number of islands in the sea of which 383 are uninhabited, and many of them rocky; long, narrow fjords; a great number of streams, creeks and brooks, ponds and lakes; vast marsh lands; sand-dunes; large closed and open bays; moorlands and heath; great pine and spruce forests in addition to deciduous forests; and farmland with many fencerows and windbreaks.

The importance of Denmark's location in the sea has been discussed above.

The long sea-shore affords habitat for a variety of birds, on the sand strand itself breed the least tern, semipalmated plover, oyster-catcher and others; on the adjoining strand meadows a great many birds may be found breeding: gulls, terns, ducks and shore birds.

The islands are often densely populated with birds: gulls, terns, ducks and shore birds. On rocky islands breed eiders, turnstones, kittiwakes, murres, razor-billed auks and black guillemots. Along the fjords are sometimes found strand meadows with suitable habitats for waterfowl and shore birds; and the fjords are often a preferred wintering area for diving ducks, loons and gulls.

Ponds and lakes harbor waterfowl and shore birds; marsh lands the same variety of species plus others as various harriers, bitterns and godwits. In not too wet marsh lands the short-eared owls occur.

The sand-dunes have a very characteristic flora, but bird life is scarce, wheatears, *Oenanthe oenanthe*, being one species that commonly is found there, in addition to gulls and terns from the nearby sea.

The heath, occupying 7.5 per cent of the total land area, is a very characteristic type of land with a very distinct flora and fauna. Birds characteristic of the heath are the golden plover, black grouse, *Lyrurus tetrix;* and wood sandpiper, *Tringa glareola*, in the wetter parts. Since 1930 the curlew, *Numenius arquata*, has started breeding in increasing numbers (Westerskov, 1942 a), and seems to take over certain heaths after the plover that has decreased in number.

Since about 1870 increased plantings of conifers have been made because of the high prices for softwood. These plantings have resulted in a rapid increase in coniferous forest lands. Newcomers to these plantations are the crested tit, *Parus cristatus*, which immigrated to Denmark as a breeding bird in the last decade of the 19th century, and since has spread to plantations all over Jutland (Jespersen, 1944); mistle thrush, *Turdus viscivorus*, red crossbill, *Loxia curvirostra*, green woodpecker, Montagu's harrier, *Circus pygargus*, European woodcock, and others (Poulsen, 1947).

Concerning land-use methods, the extensive use of fencerows and windbreaks especially, is of great benefit to the bird life in Denmark. The fencerows furnish shelter, nesting sites and food for a great variety of Passerines. The influence of fencerows on the number of birds present will be discussed further in another paper.

Ohio does not offer the variety of habitats found in Denmark. The number of birds found in the farm land section is lower because of lack of fencerows for shelter and nesting sites. The intensive farming of vast areas of the same crop

does not yield the variety of food and nesting sites as the smaller, often irregular shaped Danish fields.

### CLOSELY RELATED SPECIES IN ADDITION TO IDENTICAL ONES

In addition to the species, mentioned in Table 2, that have been recorded from both Ohio and Denmark, a number of other birds, very much alike in general appearance, are found in both areas.

Many of the species I refer to here are so much alike that they can not be told apart when seen in the field, as e.g., the American great blue heron, *Ardea herodias*, and the European common heron, *Ardea cinerea*. Others, as e.g., the blue jay, *Cyanocitta cristata*, and the European jay, *Garrulus glandarius*, behave and act alike, live in comparable habitats, are shaped alike, and their voices are much alike, but they vary somewhat in size and color.

These species, that are listed in Table 3, contribute probably almost as much to the similarity of Ohio and Denmark avifaunas as all of the 99 identical species lumped together. Many of the birds of this group are common breeding birds in both areas, whereas only a very few of the identical species, listed in Table 2, do breed commonly in both regions.

A matter like this can only be based on a personal estimate of which birds appear alike to the observer. The following list is proposed as such a list, with all the limitations such a list may have.

TABLE III

CLOSELY RELATED BIRD SPECIES FOUND IN OHIO AND DENMARK

Key symbols as in Table I

| OHIO | | DENMARK | |
|---|---|---|---|
| NAME | OCCURRENCE | NAME | OCCURRENCE |
| Great blue heron, *Ardea herodias* | CM, NL | Common heron, *Ardea cinerea* | CM, NC |
| Am. bittern, *Botaurus lentiginosus* | CM, NL | Eur. bittern, *Botaurus stellaris* | NL |
| Redhead, *Nyroca americana* | UM | Pochard, *Nyroca ferina* | NLC, CM |
| Sharpshinned hawk, *Accipiter velox* | UM, RN | Sparrow hawk,† *Accipiter nisus* | NC, CM |
| Redtailed hawk, *Buteo borealis* | UWRes, RN | Buzzard, *Buteo buteo* | NC, CM |
| Bald eagle,* *Haliaetus leucocephalus* | RWRes, VRN | Sea eagle, *Haliaetus albicilla* | EN, UW |
| Virginia rail, *Rallus limicola* | UM, NL | Water rail, *Rallus aquaticus* | NL, CM |
| Sora, *Porzana carolina* | NL, CM | Spotted crake, *Porzana porzana* | NL, UM |
| American coot,* *Fulica americana* | CM, NL | Coot, *Fulica atra* | NC, CM |
| Golden plover, *Pluvialis dominica* | UM | Golden plover, *Pluvialis apricaria* | NL, CM |
| Woodcock, *Philohela minor* | UM, NL | Woodcock, *Scolopax rusticola* | NL, CM |
| Am. Avocet,* *Recurvirostra americana* | Ca. | Avocet, *Recurvirostra avosetta* | NCL |
| Bonaparte's gull, *Larus philadelphia* | CM | Black-headed gull, *Larus ridibundus* | CW, NC, CM |
| Ring-billed gull, *Larus delawarensis* | CM, UWRes | Common gull, *Larus canus* | NC, CM, CW |
| Great horned owl, *Bubo virginianus* | URes | Great horned owl, *Bubo bubo* | EN, RW |
| Barred owl, *Strix varia* | URes | Tawny owl, *Strix aluco* | NC, Res |
| Whip-poor-will, *Caprimulgus vociferus* | NL, CM | Nightjar, *Caprimulgus europæus* | NCL, UM |
| Chimney swift, *Chætura pelagica* | NL, CM | Swift, *Apus apus* | NC, CM |
| Hairy woodpecker, *Dryobates villosus* | CRes | Great spotted woodpecker, *Dryobates major* | NC, Res |
| Crow,* *Corvus brachyrhynchos* | VCM, CN | Crow, *Corvus corone* | NC, CM, CW |
| Blue jay, *Cyanocitta cristata* | CRes | Jay, *Garrulus glandarius* | NC, CM |
| Whitebr. nuthatch, *Sitta carolinensis* | CRes | Nuthatch, *Sitta europæa* | NC, Res |
| Wood thrush, *Hylocichla mustelina* | CM, NL | Song thrush, *Turdus ericetorum* | NC, CM |
| Golden-crowned kinglet, *Regulus satrapa* | CM, UWRes | Goldcrest, *Regulus regulus* | NC, Res, CM |
| Eastern phoebe, *Sayornis phoebe* | NC, CM | Spotted flycatcher, *Muscicapa striata* | CN, CM |
| Pine siskin, *Spinus pinus* | UM, RWRes | Siskin, *Carduelis spinus* | NL, CM, CW |

*Certain similar American and European species of birds are considered by a group of ornithologists to be races of the same species and could accordingly be listed in Table II. These include, for example: the American bald eagle and European sea eagle, coot, avocet and crow.

† Not to be confused with the American "sparrow hawk:" the Am. kestrel, *Falco sparverius*.

It is obvious, however, that some other species, found in exactly the same habitats, are more or less alike, even if the difference in size or appearance is so great they do not have much similarity in appearance.

These birds, which have what might be called ecological niche similarities, are:

Belted kingfisher, *Megaceryle alcyon* in Ohio and kingfisher, *Alcedo atthis*, in Denmark, both living at streams and lakes, having their nests in a burrowed hole in stream banks.

Flicker, *Colaptus auratus*, in Ohio and green woodpecker, *Picus viridis*, in Denmark, both mature forest species, much alike in behavior, size, flight and screech.

Robin, *Turdus migratorius*, in Ohio and blackbird, *Turdus merula*, in Denmark, both being woods-parks birds, and living in gardens and where possible around human dwellings.

Finally two species may be mentioned which live in the same ecological niches, and playing the same role in people's mind as messengers of spring, namely, the Killdeer, *Charadrius vociferus*, in Ohio fields, and the lapwing, *Vanellus vanellus*, of Danish fields. Where you look for lapwings in the fields of Denmark, you look for killdeer in Ohio.

In order to test my idea about this I asked Dr. Daniel L. Leedy, of the Ohio Wildlife Research Unit, who served in England during the war, what the counterpart of the killdeer was in England. And I got the answer: Lapwing.

## A GENERAL AVIFAUNISTIC COMPARISON

It is difficult to summarize the heterogenous bulk of information given above. Certain conclusions may be derived, however, concerning similarities in the bird faunas.

The two types of habitats where the greatest similarity is found are urban areas and water areas.

In cities English sparrows and starlings are as common in Ohio as in Denmark, and during the summer time the swifts are seen over Ohio cities as well as over Danish cities.

Lake shores, islands, ponds and streams have, however, the greatest number of similar birds: ducks, gulls, terns, shore birds, coots, gallinules, etcetera.

Farmlands in both areas have the introduced pheasant and the European partridge, whereas most of the other birds found in the fields are different.

Birds of the forests are not much alike, certain birds-of-prey, crows, wrens, kinglets, and others, occur in both areas, some of them in the same species, others belonging to various genera, but yet rather alike.

For convenience in comparing the avifaunas of Ohio and Denmark the birds may be grouped as follows:

1) Subspecies that are identical and occupying the same ecological niches, and breeding commonly in both areas, as the introduced sparrows and starlings; other species as mallard and bank swallow.

2) Species that are alike, but different subspecies, breed in both areas, as the barn swallow, marsh hawk and gallinule.

3) Species that are different (yet much alike in appearance), but belonging to the same genus, occupying the same ecological niches, and breeding in both areas, as the great blue heron, coot, and sharpshinned hawk.

4) Species that belong to different genera, but yet are so externally alike that they are easily recognized as "identical" when seen in the field, as the woodcock and chimney swift.

5) Species that are definitely different in color pattern or size, but which

occupy the same ecological niches, as the belted kingfisher, flicker and robin in Ohio compared to kingfisher, green woodpecker and blackbird in Denmark.

How similar or dissimilar the general bird picture is will best appear from some examples of birds seen at various seasons and in various habitats in the two areas.

During a trip to the University woodlot, Ohio State University's farm, on April 6, 1947, I saw 21 species of which only two could have been seen on a similar trip in Denmark, namely, English sparrow and starling. Species rather similar to Danish species found in similar habitat, were the kestrel, flicker, phoebe and crow.

During a trip to the forest at Barrit, Vejle Fjord, Denmark, on April 9, 1944, I saw 24 species of which only the starling could have been found in Ohio, too. Species resembling American ones were crow, green woodpecker, great spotted woodpecker, buzzard and sparrow hawk.

On a trip to Starve Island, Lake Erie, June 18, 1947, I found five species breeding on the small island, of which the two, common tern and herring gull, breed in similar habitats in Denmark, and two of the others have "relatives" in similar Danish habitat, namely, the black duck and spotted sandpiper.

On a trip to the island of Langli in Ho Bugt in Denmark, June 4, 1942 (Westerskov, 1942 b), I observed 15 species of birds of which the 14 were breeding. Of these 14 species five could have been found in a similar habitat in Ohio, namely, semipalmated plover, herring gull, common tern, barn swallow, and starling (the last two breeding at the shepherd's house).

These few examples could be supplemented with many more, but they give a little idea about which similar species are seen.

The variety in habitats in the Danish archipelago compared with the more homogeneous look of the state of Ohio as a small part of a vast continent affords possibilities for interesting comparisons in faunistic and floristic fields.

Further studies and comparisons between regions in various parts of the world are suggested, and might yield unexpected results not only concerning ecological compositions and evolution, but might even render a basis for suggestions in applied phases of ecology, as wildlife management, agriculture and forestry.

## SUMMARY

In spite of various geographical locations and differences in climate, vegetation, landscape form and land-use, the State of Ohio and the Kingdom of Denmark have a certain degree of similarity in avifaunas, especially concerning the water birds: ducks, gulls, terns, etc.

Three hundred and forty-three species of birds have been recorded from Ohio, and 334 from Denmark. Of these no less than 99 species have been recorded in both areas. Sixty-four percent of these are water or wading birds.

Most of the birds recorded from both areas are more common in Denmark than in Ohio. Of the 46 species breeding in either country, 13 breed in both areas, 8 in Ohio only, and 25 in Denmark only.

The main reasons for the proportionately greater number of species in Denmark and greater frequency of those species present are thought to be first, the geographical position of the country as an apex of the European continent, thus being the connecting link (flyway) between western Europe and Fenno-Scandia–Siberia, and affording wintering grounds for many northern birds, especially diving ducks.

Second, Denmark is an archipelago consisting of one peninsula and 483 islands, thus getting its share of migrating and wandering around water birds.

Third, both areas are more or less intermediate between northern and southern faunas, but Denmark most so.

Finally, there is a diversity in vegetation, landscape form and land-use in Denmark not found in Ohio.

In addition to identical species occurring in the two areas a number of birds are so much alike that often they cannot be identified in the field. Twenty-six such species are listed.

Greatest similarity in the avifaunas are found at lakeshores and seashores, and in towns. Very few birds of field and forest are the same in the two areas.

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